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Saks et al. In so doing, the Office Action notes that the claimed semiconductor devices are in part defined by process language, and correctly notes that to be patentable, the resultant products themselves must be distinct from the prior art products. As detailed below, the claimed products are in fact patentably distinguished from the prior art. Reconsideration and withdrawal of these rejections and allowance of this application are therefore requested.

WO 94/19829 is asserted in the Action to teach "a semiconductor device having a MOS device, the semiconductor device having an interface between a silicon layer and a gate oxide layer, the semiconductor device being treated with deuterium". Saks et al. is asserted to teach "a semiconductor device comprising a field effect transistor having a Si-SiO₂ interface being treated with deuterium". Correctly noting traditional product-by-process doctrine which provides that the claimed product itself must be patentably distinct from the prior art, the Office Action questions whether the claimed products are in fact distinct from those of the prior art. The discussions below clearly demonstrate that they are.

The Office Action cites In re: Thorpe et al., 227 U.S.P.Q. 964 (CAFC 1985) as illustrative of a situation where product-by-process language was insufficient to distinguish the prior art. The present situation, however, is highly dissimilar to that in Thorpe. In Thorpe, the applicant claimed a novolac phenol-aldehyde resin in product-by-process format, and did not assert that the claimed product differed from products produced in the prior art. In fact, the applicant in Thorpe made admissions

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evidencing that the products were the same. In this context, the court found that the product-by-process claims were unpatentable.

The law is equally clear, however, that product-by-process claims which operate to define products distinguished from the prior art products are patentable. In the present case, all pending claims require "a field effect transistor having an interface between a semiconductive silicon layer and a gate oxide layer, characterized by post-fabrication passivation of said interface in a heated, deuterium gas-enriched atmosphere" and wherein such post-fabrication passivation is "conducted sufficiently to provide to said transistor a practical lifetime at least ten times that provided by a corresponding passivation with hydrogen". In this regard, the teachings of the application are that post-fabrication passivation means after the conductive conducts have been provided (see page 12, lines 11-12). Such products, as claimed, are clear of the prior art, and therefore patentable.

Neither WO 94/19829 nor Saks et al. teaches that passivation should be conducted post-fabrication, using a deuterium enriched atmosphere under heated conditions, sufficiently to achieve high-level increases in transistor lifetime, as claimed. Moreover, such passivation processes characterize and render the resultant field effect transistors structurally distinct from transistors not subjected to such post-fabrication passivation. When post-fabrication passivation in a heated, deuterium-enriched ambient as claimed is utilized, the deuterium detectably populates in and around the conductive contacts for the source, drain and gate of the transistor. Absent the presence of such contact structures during treatment with

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deuterium, these structures would not be similarly populated. Accordingly, semiconductor devices having transistors characterized by post-fabrication passivation as claimed are structurally distinguished from devices such as those described in WO/94/19829 and Saks et al which are otherwise treated with deuterium.

Furthermore, as expressly provided in the claim language, the devices of the present invention have highly increased resistance to degradation from hot carrier effects during operation, a feature which also must be considered when assessing the invention as a whole. Such surprising, large improvements have been acknowledged in subsequent publications. For example, I.P. Ipatova et al., *J. Appl. Phys.* 83(2), acknowledges the giant increase in transistor lifetime, and discusses potential explanations for the same involving adatom localized vibrations. These large lifetime improvements are in fact much greater than might have been surmised from prior-discussed differences between hydrogen and deuterium such as different zero-point energy levels and kinetic isotope effects [see e.g. WO 94/19829 itself] that may have affected their behavior in semiconductor devices. Such unexpected advantages are highly supportive of patentability in consideration of the invention as a whole.

For these reasons, it is submitted that the claimed field effect transistor devices are patentably distinguished from WO 94/19829 and Saks et al., and that the rejections under 35 U.S.C. § 103 should be withdrawn.


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In view of the foregoing amendments and remarks, it is believed that this application is in condition for allowance containing claims 40-48 and 60-61. Action to that end is solicited. The Examiner is invited to telephone the undersigned attorney if there are any questions about this submission or other matters that may be addressed in that fashion to expedite the allowance of this application.

Respectfully submitted,

By


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SPECIAL REMARKS:
Pursuant to our telephone discussion this morning, transmitted is a
RESPONSE AFTER SECOND OFFICE ACTION for U.S. Serial No. 09/160,657.
Thank you.

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